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ABSTRACT

A study investigated the roles of phonological encoding and visual processes in word recognition in American learners of Arabic as a foreign language. Subjects were 36 individuals with proficiency ranging from beginning to native. Two experiments in word recognition were conducted, one at word and one at sentence level. At each level, the word recognition task was either phonological or visual. Both experiments were conducted with a personal computer. Results show the learners of Arabic used both visual and phonological strategies to assess Arabic words at both word and sentence levels, continuing to make incorrect judgments through all proficiency levels as manifested in both visual and phonological errors. As reading proficiency increased, error rates of both phonological and visual tasks decreased. Phonological errors were virtually absent in native speakers, and visual errors were infrequent. Recommendations for instruction include: (1) emphasis on critical sounds and letters that may cause confusion in identification; (2) encouragement of a learning strategy using phonology plus spell-checking, especially at lower reading levels; (3) attention to vocabulary and structures that contain critical sounds or have high visual similarity in context; and (4) maximum manipulation of the linguistic codes, especially at lower reading levels. (Contains 27 references.) (MSE)

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Phonological and Visual Processes in Word Recognition by American Learners of Arabic as a Foreign Language[1]

Phonology and script of the target language are two main components of the reading process. Little is known about their roles in word recognition, which is central to reading comprehension. This study reports an investigation into the role of phonological encoding (speech recoding) and visual processes in word recognition of American learners of Arabic as a foreign language (AFL). American learners traditionally confuse /ḥ/ for /h/, /x/ for /k/, and /ᶜ/ for /'/ in both the written and oral production. Moreover, they appear to have difficulty arriving at the right meaning of Arabic words that have these sounds. The study also tries to investigate as to when American learners of AFL develop an awareness of recognition of these perceived critical sounds (/ḥ/, /x/, and /ᶜ/), for example, in Arabic in two modes, a visual mode and an auditory mode.

Introduction

Word recognition, a central component of reading comprehension, has been widely regarded as being mediated by two routes, phonological and visual (Coltheart, 1978; Humpherys & Evett, 1985). In first language (L1) reading, skilled readers, according to some researchers (Doctor & Coltheart, 1980; McCusker, Hillinger, & Bias, 1981), access printed words directly while beginning readers depend heavily on grapheme-phoneme correspondences. On the other hand, second language (L2) reading is a complex process that entails learning a second encoding system. Encoding is a process by which readers try to hold extracted information from print in the short-term memory either in a phonological (Conrad, 1972; Goodman, 1972; and Morton & Patterson, 1980) or in a visual form (Bower, 1970; Kolers, 1970; and Myer et al., 1974) to activate or access meaning. Research in foreign language has shown that phonology of the target language seems to pose a problem in learning to read a second or a foreign language (Hatch, 1971;

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Serpell, 1968; Tullis, 1971). It has demonstrated the fact that readers rely on a variety of sources of information in identifying words. These sources of information include orthography, phonology, syntax, and semantics (Bernhardt, 1986; Gibson & Levin, 1975; Spiro, 1980; and Stanovich, 1980). L2 learners of different L1 backgrounds are presumed to rely either partially or totally on the above-mentioned components or sources of information to identify words, whether words are logographic (Chinese or Japanese), or alphabetic (English or Arabic).

Orthography and the sound system of the target language are but the first components that L2 learners must learn and acquire. As far as the issue of encoding (phonological vs. visual)--in L2 acquisition in general, and in reading in particular--is concerned, little research has been carried out with L2 readers of alphabet-based languages. Muchisky (1983), for example, found that students of English as a second language of varying L1 backgrounds (Spanish, Persian, German, French, Japanese, and Chinese) had much slower reaction times on phonological lexical decision tasks. He assumes that phonological interference from L1 is a possible cause for this phenomenon. In the same sense, Hatch (1970, 1974) found that native speakers of Banu and Spanish misread and misinterpreted words based upon lack of knowledge of English phonology. She concluded that phonological encoding does occur in silent reading; moreover, phonological interference results. It appears that L2 learners may need to develop an awareness of the sound system of the target language in order to disambiguate recognition.

The Arabic Writing System

Arabic is an alphabetical language and its script is considered to be virtually representative of the sound system; it is highly phonemic. Its script is cursive and written from right to left. Most of its alphabet, moreover, is

represented in four forms: Separate, initial, medial, and terminal (see figure 1). Figure 1 illustrates the phenomenon of the four different shapes that an Arabic letter assumes, depending on its position in a word. This characteristic of cursivity in Arabic--which makes almost every letter of its alphabet have a different shape depending on its position in the word--is most problematic for beginning level learners in terms of recognizing the words.

ملح	صباح	محمود	حبيب
milḥ	ṣabāḥ	maḥm ūd	ḥabīb

Figure 1. The Characteristic of cursivity of the letter /ḥ/ = (ح).

The sound system, in addition, poses another potential difficulty for the L2 learners. Although there is one-to-one correspondence between graphemes and phonemes, American readers of Arabic appear to have difficulty arriving at the right meaning of words that have certain sounds, which are considered critical for perception. In other words, Arabic has a set of consonants that do not exist in English. Some of these cosonants are represented phonetically as the following: (ḥ), (ᶜ), and (x) On the surface level, it appears that these sounds are merely problematic in articulation or pronunciation. Observations of data generated by American learners of Arabic as a foreign language demonstrate that those learners, at various stages of their proficiency levels, substitute (ᶜ) for ('), in the oral mode, pronounce (X) as (k), and (ḥ) as (h). A similar behavior is manifested by American learners of Arabic when the production of these sounds is in the written mode. That is, American learners have produced--in free writing--words like أعرف = 'aᶜrifu (to know), أحب = 'uḥibbu (to like), and أخ = 'akh (brother) as أرف = 'arifu (non-word), أهب = 'uhibbu (non-word), and أك = 'ak

(non-word) respectively. Other examples of this type of error include علم = ʿalam (flag) and خبير = khabīr (an expert) as ألم = 'alam (pain) and كبير = kabīr (big).

Purpose of the Study

Given the orthographic differences between English (Roman-alphabet) and Arabic (non-Roman alphabet), and the problem incumbent in learning to encode a second system like Arabic, an investigation of the issue of encoding (phonological or visual) and word recognition in Arabic during silent reading is important. To be more specific, this study tries to address the following: How do English-speaking learners process Arabic words in isolation and in context? In other words, do they use a phonological and/or visual strategy to identify Arabic words? From this general question the following specific questions are derived: (1) What is the role of the sound system of Arabic in word recognition by American learners? And (2) What is the role of the graphic variation of Arabic in word recognition by American learners of Arabic as a foreign language? Put differently, do the phonological and graphic systems of Arabic play a role in the identification of Arabic words by American learners of Arabic as a foreign language?

Procedures

The study was conducted using a total of 36 subjects who represented a complete range of language proficiency--beginning (A1), intermediate (A2), advanced (A3), and native (A4)--participated voluntarily in the study. Two experiments (I & II) that dealt with word recognition were conducted for this study. Experiment I was at the word level and experiment II was at the sentence level. A one-between-one-within mixed design was used in both experiments that comprised the study. Two sets of data (percentage of type of errors made) were collected and submitted to separate two-way analyses of variance (ANOVA).

The word recognition task was either phonological (B1) or visual/graphic (B2). In experiment I, subjects were presented (on a computer screen) seventy-two (two sets: Thirty-six each) groups of related words. The first thirty-six groups served as probes. Each group of words (four)--appeared on the screen of the computer for several seconds (six to seven)--was semantically related and had a target word that was assumed critical to L2 learners of Arabic. The second thirty-six groups of words served as responses. Each group of words (response) had two distractors--a phonological and visual-- of a target word (assumed critical) in a probe. Figure 2 illustrates an example of the stimulus materials of experiment one:

Probe: أذن = 'uḏun وجه = wajh أنف = 'anf عين = ᶜayn (target word)

Ear Face Nose Eye

Response: أذن = 'uḏun وجه = wajh أنف = 'anf غين - ġayn أين = 'ayna

Ear Face Nose Name of a letter Where

عين = ᶜayn (an eye) (a target word)

أين = 'ayna (where) (a phonological distractor)

غين = ġayn (name of a letter) (a visual distractor)

Figure 2: An Example of a Probe and Response

After the probe disappeared, another group of words (responses) appeared on the screen of a computer. Two distractors--phonological and visual--were embeded in place of the target word in the probe in the responses. This was done by manipulating the target word by giving two versions of the distractor. A phonological distractor--a homophone of the stimulus as perceived by L2 learners--and a visual, graphic, distractor--any combination

of letters--that constituted a resemblance (look alike) of the stimulus were developed. The researcher constructed a phonological and visual distractor of a target word by manipulating only the critical letter that existed in the target word without changing its position. This procedure of manipulation was necessary in Arabic because letters in Arabic assume different shapes in different positions of a word. A clear cut distinction, moreover, between the two distractors was obtained. The subjects' task was identifying words read from a probe. The phonological task involved subjects identifying the target word as a phonological distractor. Likewise, the visual task involved subjects identifying the target word as a visual distractor.

In experiment II--word recognition on the sentence level--fifty-four sentences were developed. There were three types of sentences. Each one of these sentences rendered a complete sentence of written Arabic. The first group of sentences had no distractors, determined to be accurate and true, served as the control. Sentences of the second and third type contained either a graphic distractor or a homophone as perceived by L2 learners of a critical Arabic word, and were incorrect. Figures 3, 4, and 5 (see figures below) illustrate the types of sentences used in the second experiment. Subjects demonstrated word recognition by indicating whether each sentence they read from a presented set of sentences on the screen was acceptable or not. One sentence was presented at one time for six to seven seconds. Both experiments of this study was carried out using a Macintosh Plus computer. The stimuli material and responses were programmed using the Hyper Card software.

سأدرسُ فلسفة في الخريف

sa'adrusu falsafatan fi l'kharīfi

Figure 3. A Correct Sentence Used as a Control.

(It has no distractors at all)

آكلُ جبراً وجبناً وزيتوناً

ākulu jabran wa jubnan wa zaytūnan

The combination of letters " جبراً" is a visual distractor of a target word " خبزاً= bread"

Figure 4. A Sentence With a Visual (Graphic) Distractor.

الكتاب تهت الدفتر

al-kitābu tahta d-daftari

The combination of letters " تهت " is a phonological distractor (as perceived by English-speaking learners of Arabic as a foreign language) of a target word " تحت = under).

Figure 5. A Sentence With a Phonological Distractor.

Analysis and Discussion

Table 1
Means and Standard Deviations
for the Level of Language Proficiency Variable
Experiment I (word level)

	N	Mean	S.D.
Beginning	18	43.667	12.044
Intermediate	18	38.266	14.869
Advanced	18	28.074	10.610
Native	18	3.547	4.018

Table 2
Means and Standard Deviations for the Word Recognition Task
(Experiment I)

	N	Mean	S.D.
Visual	36	28.695	17.843
Phonological	36	28.082	20.234

Table 3
Summary Table for Two-way Analysis of Variance for Experiment I

Source	df	SS	MS	F
Level of Language Proficiency	3	17067.694	5689.231	46.06*
Word Recognition Task	1	6.746	6.746	0.06 N.S.
Interaction Level by Task	3	794.270	264.756	2.32 N.S.
Within Groups S/A	32	3659.528	114.360	
Within Groups BxS/A	32	3952.822	123.525	
Total	71	25481.062		

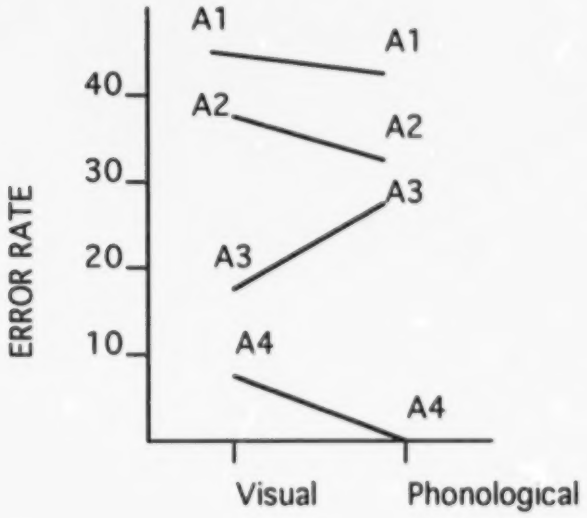
* $P < 0.0001$

The above summary table (table 3), a two-way analysis of variance, for experiment I shows that the level of language proficiency (A1 - A4) is

significant ($P < 0.0001$). The non-native readers made significantly more errors on both tasks (visual & phonological) than did the natives. Figure 11, for example, shows that the beginning and intermediate non-native readers (A1 & A2) made more visual errors than they did phonological errors while the advanced non-native readers (A3) demonstrated the opposite. Tukey tests, moreover, showed that the beginning and intermediate levels of reading proficiency are statistically different from the advanced and native levels. Non-native readers at the advanced level made fewer mistakes on both tasks (visual and phonological) than did the beginning and intermediate levels. All errors made by non-native readers regardless of level, moreover, decreased as level of language proficiency increased. This suggests that developmental changes occur and that non-native readers develop into competent readers in the target language as their reading proficiency develops. In other words, the results of this experiment suggest that the non-native readers developed an awareness of the sound and orthographic system of the target language, Arabic, as their reading proficiency developed. This awareness is manifested through the decrease of errors made on both tasks (visual and phonological) across all levels of language proficiency.

The native readers made the fewest errors on both tasks, and this is expected. The most striking finding is that there is a substantial difference in error rates between the advanced non-native and native groups ($\bar{x} = 28.074$ vs. $\bar{x} = 3.547$). Generally in L2 reading, it is expected that advanced non-native readers would show reading behaviors that are similar to those of the natives. In this study, the reading behaviors of the advanced non-natives, however, were different from those of the natives to a large extent. This phenomenon suggests that the process of learning an L2 that is written in a non-Roman alphabet language--like Arabic--is relatively slow, and that

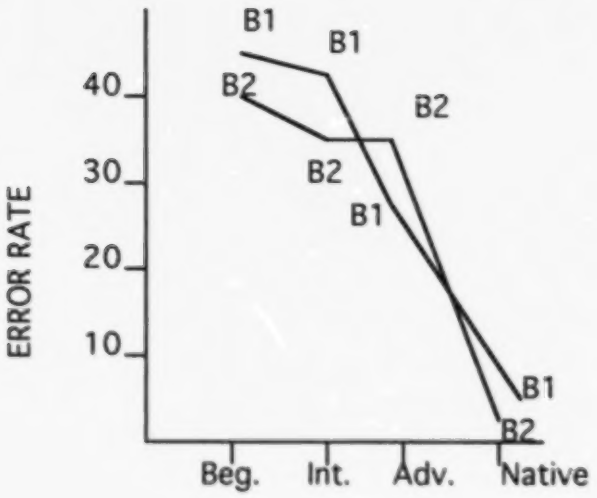
L2 learners have to develop a set of visual and phonological strategies (Bernhardt, 1986) as a necessary stage to acquire the graphic and sound systems of the L2 in question.



Note: A1 = Beginning, A2 = Intermediate, A3 = Advanced, and
A4 = Native

Figure11. Interaction of the Level of Language Proficiency variable at the levels of the Word Recognition Task variable. (Experiment I)

Note: A1 = Beginning, A2 = Intermediate, A3 = Advanced, and
A4 = Native



Note: B1 = Visual and B2 = Phonological

Figure 12 Interaction of the Word Recognition Task variable at the levels of the Language Proficiency variable.
(experiment I)

With respect to the task level (visual vs. phonological), Figure 12 (experiment I) shows that the beginning and intermediate non-native groups made more visual errors than they did phonological errors. That is, the beginning and intermediate non-native groups had more visual confusions than phonological ones. The advanced non-native group, however, made more phonological errors than they did visual errors. This finding is compatible with the L1 reading hypothesis that beginning readers depend more on the phonological route than the visual route (Coltheart, 1980; McCusker et al., 1981) while skilled readers do not. In other words, beginning readers use the grapheme-phoneme rule to access lexical entries of visually presented words. It seems that the beginning and intermediate non-native groups identified the graphic features of Arabic

words of the stimuli and then assigned phonological codes to these graphically identified words. The predominance of visual errors within the beginning and intermediate non-native groups suggests that those subjects of these groups heavily attended to the graphic features of the Arabic words presented to them. Research in L2 reading demonstrated that readers in alphabetic-second languages rely heavily on visual processing strategies especially at the beginning level (Cziko, 1980) . Because Arabic orthography is extremely cursive and variant (most letters assume four different shapes), and the subjects' knowledge of the Arabic orthography is incomplete, a heavy attendance to the graphic representations of Arabic words by American learners resulted in this study. The persistance of phonological errors as opposed to the decrease of visual errors with the advanced non-natives, moreover, points to a fact that American learners develop an awareness of the graphic system faster than they do of the Arabic phonological system.

Table 4
Means and Standard Deviations for the Level of Language Proficiency Variable Experiment II (sentence level)

	N	Mean	S.D.
Beginning	18	50.614	14.116
Intermediate	18	42.586	17.043
Advanced	18	39.809	15.626
Native	18	15.120	9.846

Table 5
Means and Standard Deviations for the Word Recognition Task
(Experiment II)

	N	Mean	S.D.
Visual	36	34.563	15.60
Phonological	36	39.502	22.567

Table 6
Summary Table for Two-way Analysis of Variance for Experiment II

Source	df	SS	MS	F
Level of Language Proficiency	3	12657.367	4219.122	17.65*
Word Recognition Task	1	439.116	439.116	3.13 N.S.
Interaction Level by Task	3	1553.137	517.712	3.69 **
Within Groups S/A	32	4488.819	140.275	
Within Groups BxS/A	32	7650.806	239.0876	
Total	71	26789.247		

* $P < 0.0001$

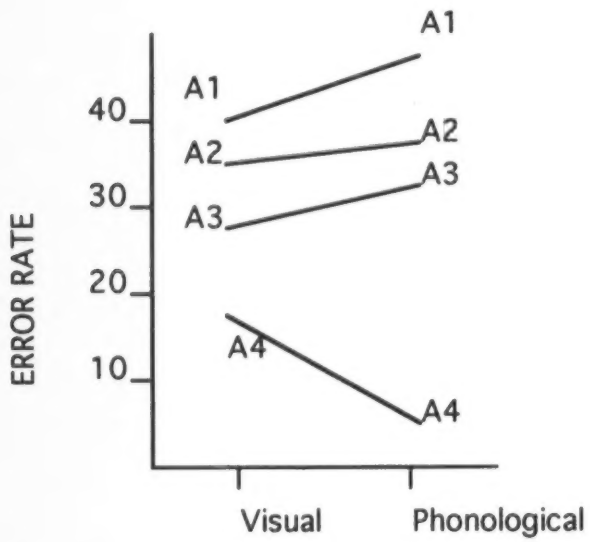
** $P < 0.02$

Results of Experiment II

Figure 13, figure 14, and table 4 show that all non-native readers made more errors (phonological and visual) than did the natives and that the phonological errors were dominant. That is, non-native groups made more phonological errors than they did visual errors when tasks were embedded in sentences; the task variable was not significant, however. According to some L1 reading hypotheses (Kleiman, 1975), readers hold information extracted from printed materials on the sentence level by their phonological code for further processing. In light of this hypothesis, it could be suggested that all non-native groups try to hold information extracted from the sentences of the stimuli by their phonological code. That is, subjects tried to access words using the phonological route. Because the subjects' knowledge of Arabic phonology is deficient, phonological errors were made. This finding is consonant with some research results that foreign language learners hold information extracted from printed materials by their phonological representation (speech recoding), especially on the sentence level, for further comprehension (Hayes, 1986).

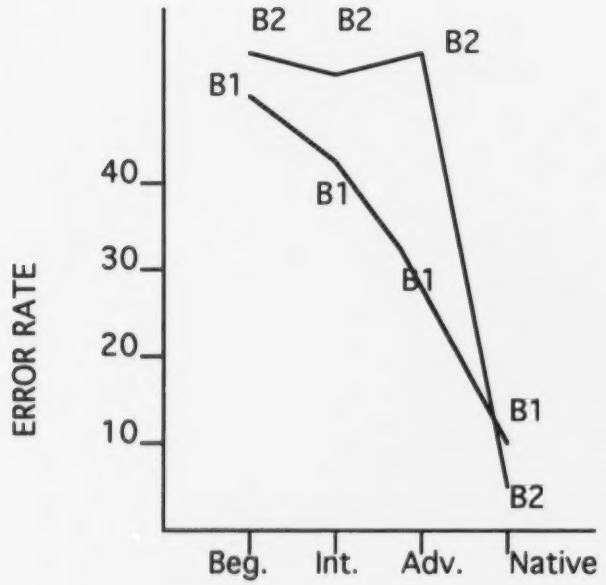
In experiment II (the sentence level), interaction is significant. All the interaction means are different (Table 6). The analysis of variance shows that the overall interaction is significant at the level of 0.02 (Table 6). The Post-hoc test reveals that the interaction between any two levels of language proficiency (beginning through advanced) is not significant; but the interaction at the native level is significantly different from the interaction at all other levels of language proficiency. An interpretation of this finding is that non-native readers process Arabic words using two strategies--phonological and visual without any dominance of either strategy on the other. The phonological and graphic systems of Arabic, moreover, seem to

pose potential problems through all levels of language proficiency to American learners of Arabic as a foreign language.



Note: A1 = Beginning, A2 = Intermediate, A3 = Advanced, and A4 = Native

Figure 13. Interaction of the Level of Language Proficiency variable at the levels of the Word Recognition Task variable. (Experiment II)



Note: B1 = Visual and B2 = Phonological

Figure 14. Interaction of the Word Recognition Task variable at the levels of the Language Proficiency variable. (experiment II)

This finding in both experiments is expected. In light of the dual-encoding hypothesis, readers employ two routes--visual and phonological--to identify words. In other words, readers access the meaning of printed materials either visually or phonologically. Reading theorists, moreover, claim that the two routes work independently and in a non-interactive way. Although the analysis of variance did not show any statistical significance on the task variable, the predominance of visual errors in experiment I and phonological errors in experiment II is obvious (Figures 12 & 14). Upon examining the data of the present study, one can surmise that the non-native readers were more dependent on the visual route than the phonological one while reading words in isolation (experiment I). The dominance of visual errors over the phonological errors in experiment I

demonstrates a preference for visual processing in this study. In experiment II (the sentence level), on the other hand, the dominance of phonological errors over the visual ones suggests that a phonological route was faster than a visual one, and demonstrates a preference for phonological processing. Put differently, the American learners of Arabic as a foreign language used both strategies--visual and phonological--to access words. The visual route seemed to be more dominant in experiment I than the phonological one while the opposite was demonstrated in experiment II.

In both experiments (I &II), the virtual absence of phonological errors by native readers and an abundance of errors by non-native readers suggest that the non-native readers applied grapheme-phoneme correspondence rules to form a phonological representation, especially at the lower levels of reading proficiency. To this end, Gough (1972) and Hillinger (1980) claim that developing a grapheme-phoneme correspondence is a necessary procedure that enables beginning readers to construct gradually integrated orthographic-phonological representations in the lexicon. Having done that, readers eventually access words using the direct route, the visual one. In light of the present data, this hypothesis is compatible with data from the native group. This hypothesis, however, seems to contradict the results that pertain to all groups of the non-native readers because phonological errors continued to occur. A plausible interpretation for this phenomenon could be that phonological representation of certain words in Arabic was faulty and, hence, the misidentification. In other words, American learners of AFL seemed to apply their knowledge of Arabic phonology to the reading task, and because this knowledge is incomplete or incorrect, reading was impaired and misidentification of words resulted. This phenomenon parallels the findings of Muchisky (1983) and Hatch (1974).

The analysis of the data of the present study does not show any clear cut evidence as to when non-native readers of Arabic develop an awareness of the phonological system. The phonological errors persist even at the advanced level. One possible interpretation of this phenomenon could be that the high visual similarity among the Arabic letters induced such behavior. In other words, the non-native readers might have confused visually one Arabic word for another and consequently assigned a wrong sound to that word that resulted in a phonological error. This explanation could be plausible because the visual errors persist at the advanced level. This finding, moreover, shows that the non-native proficient readers were still largely attending to the visual characteristics of the Arabic letters. The deficiency in proper discrimination of the Arabic letters on the part of the non-native readers causes confusion which led them to make an incorrect judgment. L2 learners, in general, attend to the graphic representation to a great extent. Hatch (1974) and Cziko (1980) among others, claim that L2 learners attend much more to the visual characteristics of what they read than do L1 readers. American learners reading Arabic as a foreign language are overwhelmed by the distinctive shapes that an Arabic letter could assume (four shapes) depending on its location in a word. L2 learners, therefore, are confused and consequently make incorrect identification of words. To this end, Cziko (1980) claims that readers in alphabetic-second languages rely heavily on visual processing strategies especially at the beginning level.

In summary, the non-native readers seemed to have used both strategies--visual and phonological--in accessing Arabic words in both experiments--I and II. Non-natives continued to make incorrect judgments through all levels of language proficiency as manifested via both visual and phonological errors.

The present study also showed that as reading proficiency develops, error rates of both visual/phonological tasks decreased. This suggests that by time and practice, non-native readers could develop an awareness of the phonological and visual systems of Arabic. The present study, however, does not claim to have arrived at conclusive answers as to when the non-native readers become competent readers of Arabic and depend less on the phonological strategy.

This study showed that native readers read with automaticity and fluency. The virtual absence of phonological errors by native readers and their occurence in the data generated by non-native readers suggest that the Arabic phonological system plays a role in the identification of Arabic words by American learners. The very small number of visual errors, moreover, made by the native readers in this study supports the theory that fluent readers read with automatic recognition of phonological codes.

Limitations of the study

Encoding--a cognitive process-- is observed indirectly like any cognitive process. This is an inherent problem because the tasks that were included in the study are assumed to give an explanation of the type of encoding included and to examine the phonological and graphic awareness of American learners when reading AFL. Retrieving information from long-term memory could be inefficient. A matching task, moreover, could have been carried out and was not controlled for.

The results of this study are restricted to the two types of reading activities, namely the word and sentence level only. A reading task on the text level might yield different results; and therefore, the above results cannot be generalized to reading situations of texts longer than one sentence.

In addition, prior knowledge or lack of knowledge of grammar was not controlled for. The number of subjects was relatively small due to their availability at the time of the study, a larger pool of subjects should be tested to examine whether or not similar results would be obtained.

Further Research

This study is in line with other studies that belong to research in cognitive psychology. Many studies using a variety of experimental tasks are needed to investigate any cognitive act or process such as the use of phonological and/or orthographic information to help word recognition during the act of reading by L2 learners. The present study should be replicated with different test stimuli and subjects.

Reaction time studies could show which type of words would take more time to process; hence, a difficulty factor could be detected.

Additional work within the realm of encoding can be done with eye-tracking experiments. Data from such experiments would yield information about the visual processes of readers of Arabic that might explain or track graphic confusion or awareness.

The Letter-search task experiments could be conducted to examine this research question in order to assess as to when the visual and/or phonological awareness of Arabic script is developed. That is, a cross-out task would address such a question. Matching pairs research paradigms could be used to assess phonological, visual, and semantic encoding strategies. Such tasks, being performed separately, might yield additional information about the reading process of American learners of AFL.

Research is needed in this area on the text level to examine the possible relationship between the knowledge of Arabic phonology and overall reading ability with experienced and inexperienced L2 learners of AFL.

Implications

Different reading models--bottom-up, top-down, and interactive--in L1 and L2 emphasize the fact that phonology and script of the target language are but two important factors of the whole complex reading process. Proper or correct knowledge of these two systems adds to the facilitation and enhancement of the process of word identification and, consequently, reading comprehension. Eskey (1988), for example, relates these two systems to the domain of decoding skills. He puts much emphasis on the development of these skills and gives them priority over other factors, such as background knowledge. Eskey tries to support this strong stand on the importance of the development of decoding skills by giving the folowing example:

"For me, a Chinese text contains no information, and neither my best top-down reading strategies nor any amount of background knowledge on its subject will make me a successful reader of that text unless I take the trouble to learn to decode Chinese Script." (p. 96, 1988).

The same echo seems to be heard on the part of American learners of AFL. Decoding, therefore, should be emphasized. It is a cognitive process that involves textual and extratextual information, and comprehension cannot be achieved without it. The message is clear; L2 readers must, therefore, work at perfecting both textual (bottom-up) recognition skills and extratextual (top-down) interpretation strategies.

Based on the above, the findings of the present study are compatible with the theoretical bases as well as empirical research in other L2 studies. These findings suggest that American learners of AFL develop and acquire the ability to use orthographic and phonological knowledge through enough exposure to and practice of the Arabic language. Practioners, therefore, should attend to the following:

1. In addition to providing information about the Arabic phonology system, emphasizing critical sounds that might cause confusion in identification and maximizing exposure to Arabic letters and words that might pose difficulty;
2. Encouraging phonology-plus-spell-check-strategy especially at the lower levels of reading proficiency;
3. Presenting vocabulary and structures that contain critical sounds or that have a high visual similarity in context and drawing learners' attention to this similarity;
4. Asking students to manipulate the linguistic codes as much as possible, especially at the lower levels of reading proficiency.

The practical application and emphasis of the above suggestions might facilitate and enhance the process of awareness of the sound and script systems of Arabic. No advice, however, can be given regarding the promotion of conscious acquisition of Arabic phonology and script. Much research into the area of L2 phonology and orthography, in general, and Arabic, in particular, should be conducted in order to better understand the L2 reading process.

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